

Supplementary

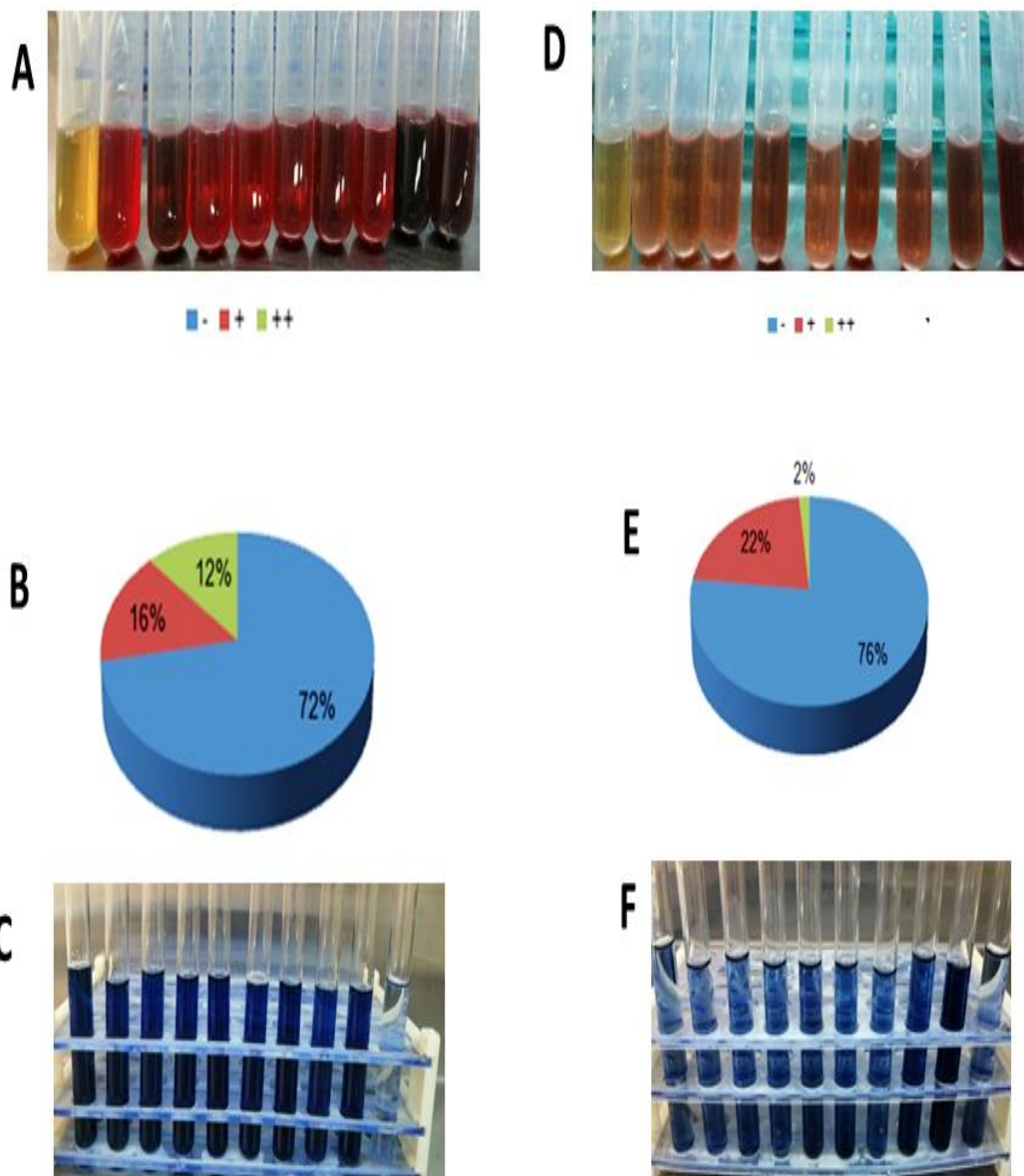


Fig. 1. Direct PGP traits of microbial endophytes; (A) IAA production, (B) Qualitative phosphate solubilization and (C) Quantitative phosphate solubilization by bacterial endophytes; (D) IAA production, (E) Qualitative phosphate solubilization and (F) Quantitative phosphate solubilization by endophytic fungi

SUPPLEMENTARY TABLE 1. Screening of endophytic bacteria for different plant growth promoting activities

| Isolate code | IAA ($\mu\text{g/ml}$) | Phosphate solubilization | | Nitrogen fixation | Siderophores production |
|--------------|--------------------------|-------------------------------------|---------------|-------------------|-------------------------|
| | | Quantitatively ($\mu\text{g/mL}$) | Qualitatively | | |
| 1RB | 10.14 \pm 0.57 | ND* | ND | ND | +* |
| 2RB | 13.37 \pm 0.58 | ND | ND | ND | ND |
| 3RB | 1.98 \pm 0.58 | ND | ND | ND | ++ |
| 4RB | 68.61 \pm 1.68 | ND | ND | ND | + |
| 5RB | 2.12 \pm 0.28 | 0.13 \pm 0.01 | + | ND | ++ |
| 6RB | 76.44 \pm 0.93 | ND | ND | ND | ND |
| 7RB | 18.67 \pm 0.98 | ND | ND | ND | ND |
| 8RB | 90.82 \pm 0.89 | ND | ND | ND | ND |
| 9RB | 20.43 \pm 1.09 | ND | ND | ND | + |
| 10RB | 22.04 \pm 0.57 | ND | ND | ND | + |
| 11RB | 17.22 \pm 0.57 | 1.01 \pm 0.09 | + | ND | ND |
| 12RB | 14.24 \pm 0.71 | ND | ND | ND | + |
| 13RB | 58.43 \pm 0.84 | ND | ND | ND | + |
| 14RB | 12.37 \pm 0.68 | ND | ND | ND | + |
| 15RB | 47.03 \pm 0.81 | ND | ND | ND | ND |
| 16RB | 23.44 \pm 1.39 | ND | ND | ND | ND |
| 17RB | 69.66 \pm 0.97 | ND | ND | ND | + |
| 18RB | 62.22 \pm 1.15 | 47.93 \pm 1.44 | ++ | + | + |
| 19RB | 12.73 \pm 0.93 | ND | ND | ND | + |
| 20RB | 24.71 \pm 0.99 | ND | ND | ND | ND |
| 21RB | 138.96 \pm 0.89 | 30.48 \pm 1.21 | ++ | + | + |
| 22RB | 63.83 \pm 0.92 | ND | ND | ND | + |
| 23RB | 12.90 \pm 0.83 | ND | ND | ND | ND |
| 24RB | 88.7 \pm 1.41 | 51.63 \pm 0.83 | ++ | + | ++ |
| 25RB | 1.35 \pm 0.08 | ND | ND | ND | + |
| 26RB | 43.45 \pm 1.36 | ND | ND | ND | ND |
| 27RB | 74.78 \pm 0.75 | ND | ND | ND | ND |
| 28RB | 11.93 \pm 0.61 | ND | ND | ND | + |
| 29RB | 85.83 \pm 1.24 | ND | ND | ND | ND |
| 30RB | 21.81 \pm 0.67 | 34.06 \pm 0.58 | ++ | ND | ++ |
| 31RB | 9.45 \pm 0.51 | ND | ND | ND | ND |
| 32RB | 18.57 \pm 1.83 | 13.30 \pm 0.98 | + | ND | ++ |
| 33RB | 45.4 \pm 0.96 | 19.41 \pm 1.24 | + | ND | ++ |
| 34RB | 10.83 \pm 0.68 | ND | ND | ND | ND |
| 35RB | 16.24 \pm 0.73 | ND | ND | + | + |
| 36RB | 36.09 \pm 0.84 | ND | ND | ND | ++ |

SUPPLEMENTARY TABLE 1. Cont.

| Isolate code | IAA ($\mu\text{g/mL}$) | Phosphate solubilization | | Nitrogen fixation | Siderophores production |
|--------------|--------------------------|-------------------------------------|---------------|-------------------|-------------------------|
| | | Quantitatively ($\mu\text{g/mL}$) | Qualitatively | | |
| 37RB | 15.62 \pm 1.29 | 2.78 \pm 0.06 | + | ND | ND |
| 38RB | 11.80 \pm 1.27 | 3.10 \pm 0.51 | + | ND | ND |
| 39RB | 4.64 \pm 0.75 | ND | ND | ND | ++ |
| 40RB | 146.35 \pm 0.50 | ND | ND | ND | ++ |
| 41RB | 104.00 \pm 1.83 | ND | ND | ND | ++ |
| 42SB | 8.69 \pm 0.97 | ND | ND | ND | + |
| 43SB | 1.81 \pm 0.13 | ND | ND | ND | + |
| 44SB | 0.51 \pm 0.05 | ND | ND | ND | + |
| 45SB | 23.00 \pm 0.98 | ND | ND | ND | + |
| 46SB | 9.52 \pm 0.71 | 1.67 \pm 0.41 | + | ND | ++ |
| 47SB | 0.42 \pm 0.06 | 13.40 \pm 1.41 | + | ND | + |
| 48SB | 40.85 \pm 1.38 | ND | ND | ND | + |
| 49SB | 1.24 \pm 0.02 | ND | ND | ND | + |
| 50SB | 4.5 \pm 0.60 | ND | ND | ND | + |
| 51SB | 0.56 \pm 0.17 | 36.14 \pm 1.06 | ++ | ND | ND |
| 52SB | 5.05 \pm 0.88 | 36.36 \pm 1.16 | ++ | ND | ++ |
| 53SB | 7.51 \pm 1.12 | ND | ND | ND | + |
| 54SB | 2.59 \pm 0.87 | ND | ND | ND | ND |
| 55SB | 1.48 \pm 0.35 | 14.53 \pm 1.16 | + | ND | ++ |
| 56SB | 1.70 \pm 0.20 | ND | ND | ND | + |
| 57SB | 24.27 \pm 1.03 | ND | ND | ND | ++ |
| 58SB | 4.47 \pm 0.86 | ND | ND | ND | + |
| 59SB | 42.16 \pm 0.92 | 49.44 \pm 0.82 | ++ | ND | ++ |
| 60SB | 20.06 \pm 1.08 | ND | ND | ND | ND |
| 61SB | 29.81 \pm 0.92 | ND | ND | ND | ND |
| 62SB | 90.06 \pm 1.08 | ND | ND | ND | + |
| 63LB | 65.46 \pm 0.93 | 12.00 \pm 0.78 | + | ND | + |
| 64LB | 27.99 \pm 1.30 | ND | ND | ND | ++ |
| 65LB | 3.61 \pm 0.57 | 6.67 \pm 0.61 | + | ND | ND |
| 66LB | 20.25 \pm 1.24 | ND | ND | ND | + |
| 67LB | 4.46 \pm 0.99 | ND | ND | ND | + |
| 68LB | 30.32 \pm 1.29 | ND | ND | ND | ND |
| 69LB | 10.79 \pm 1.10 | ND | ND | ND | + |
| 70LB | 7.14 \pm 1.05 | ND | ND | ND | + |
| 71LB | 4.48 \pm 0.87 | ND | ND | ND | ND |
| 72LB | 6.89 \pm 1.17 | ND | ND | ND | ND |

SUPPLEMENTARY TABLE 1. Cont.

| Isolate code | IAA ($\mu\text{g/mL}$) | Phosphate solubilization | | Nitrogen fixation | Siderophores production |
|--------------|--------------------------|-------------------------------------|---------------|-------------------|-------------------------|
| | | Quantitatively ($\mu\text{g/mL}$) | Qualitatively | | |
| 73LB | 9.30 \pm 0.91 | ND | ND | ND | + |
| 74LB | 10.65 \pm 1.42 | ND | ND | ND | + |
| 75LB | 28.46 \pm 1.38 | ND | ND | ND | ++ |
| 76LB | 15.66 \pm 0.86 | ND | ND | ND | ND |
| 77LB | 4.69 \pm 0.76 | ND | ND | ND | ND |
| 78LB | 150.84 \pm 1.15 | ND | ND | ND | + |
| 79LB | 4.63 \pm 0.73 | ND | ND | ND | + |
| 80LB | 15.52 \pm 1.38 | ND | ND | ND | ++ |
| 81LB | 1.46 \pm 0.17 | 2.76 \pm 0.55 | + | ND | + |
| 82LB | 11.19 \pm 1.50 | ND | ND | ND | ND |
| 83LB | 23.3 \pm 0.55 | ND | ND | ND | ND |
| 84LB | 6.66 \pm 0.92 | 33.30 \pm 1.07 | ++ | + | + |
| 85LB | 53.1 \pm 0.79 | 46.18 \pm 0.85 | ++ | + | ++ |
| 86LB | 8.57 \pm 0.98 | 10.87 \pm 0.80 | + | ND | ND |
| 87LB | 108.81 \pm 1.35 | ND | ND | ND | + |
| 88LB | 44.12 \pm 0.57 | 34.08 \pm 1.23 | ++ | ND | ++ |
| 89LB | 42.4 \pm 1.44 | 16.44 \pm 1.34 | + | ND | + |
| 90LB | 69.66 \pm 0.89 | 27.89 \pm 1.19 | ++ | ND | + |

*ND, +, and ++ denote no, low, and high production, respectively. Values are means \pm SE (n= 3).

SUPPLEMENTARY TABLE 2. Screening of endophytic fungi for different plant growth promoting activities

| Isolate code | IAA ($\mu\text{g/mL}$) | Phosphate solubilization | | Siderophores production |
|--------------|--------------------------|-------------------------------------|---------------|-------------------------|
| | | Quantitatively ($\mu\text{g/mL}$) | Qualitatively | |
| 1RF | 10.31 \pm 0.21 | ND | - | ND |
| 2RF | 11.94 \pm 0.5 | ND | - | ND |
| 3RF | 19.52 \pm 0.65 | ND | - | ND |
| 4Rf | 11.38 \pm 0.79 | ND | - | ND |
| 5RF | 15.97 \pm 0.80 | ND | - | ND |
| 6RF | 11.07 \pm 0.45 | ND | - | ND |
| 7RF | 10.33 \pm 0.25 | ND | - | ND |
| 8RF | 12.27 \pm 0.56 | ND | - | ND |
| 9RF | 13.19 \pm 0.30 | ND | - | ND |
| 10RF | 13.19 \pm 0.23 | ND | - | ND |
| 11RF | 13.66 \pm 0.55 | ND | - | ND |
| 12RF | 28.08 \pm 0.85 | 5.06 \pm 0.34 | + | ND |
| 13RF | 13.6 \pm 0.63 | ND | - | ND |
| 14RF | 12.31 \pm 0.88 | 6.58 \pm 1.2 | + | ND |
| 15RF | 32.64 \pm 1.2 | 7.3 \pm 0.97 | + | ND |
| 16RF | 27.01 \pm 1.7 | ND | - | ND |
| 17RF | 47.91 \pm 0.04 | 10.66 \pm 0.5 | + | ND |
| 18RF | 13.48 \pm 0.5 | ND | - | ND |
| 19RF | 14.06 \pm 0.75 | ND | - | ND |

SUPPLEMENTARY TABLE 2. Cont.

| Isolate code | IAA ($\mu\text{g/mL}$) | Phosphate solubilization | | Siderophores production |
|--------------|--------------------------|-------------------------------------|---------------|-------------------------|
| | | Quantitatively ($\mu\text{g/mL}$) | Qualitatively | |
| 20RF | 33.15 \pm 0.86 | 6.5 \pm 0.45 | + | ND |
| 21RF | 7.76 \pm 1.10 | ND | - | ND |
| 22RF | 7.76 \pm 0.90 | ND | - | ND |
| 23RF | 19.61 \pm 0.05 | ND | - | ND |
| 24RF | 19.36 \pm 0.34 | ND | - | ND |
| 25RF | 31.19 \pm 0.77 | ND | - | ND |
| 26RF | 11.0 \pm 0.5 | ND | - | ND |
| 27RF | 12.99 \pm 0.11 | ND | - | ND |
| 28RF | 17.2 \pm 0.56 | 2.5 \pm 0.11 | + | ND |
| 29RF | 15.16 \pm 1.5 | ND | - | ND |
| 30RF | 26.78 \pm 0.79 | 2.75 \pm 0.55 | + | ND |
| 31RF | 19.61 \pm 0.4 | ND | - | ND |
| 32RF | 11.05 \pm 0.92 | ND | - | ND |
| 33RF | 11.81 \pm 0.81 | ND | - | ND |
| 34RF | 15.78 \pm 0.05 | ND | - | ND |
| 35RF | 15.96 \pm 1.35 | ND | - | ND |
| 36RF | 46.87 \pm 0.01 | 2.8 \pm 1.5 | + | ND |
| 37RF | 81.4 \pm 1.2 | 8.7 \pm 1.3 | + | ND |
| 38RF | 21.41 \pm 0.97 | ND | - | ND |
| 39RF | 19.36 \pm 0.88 | ND | - | ND |
| 40RF | 11.71 \pm 0.74 | ND | - | ND |
| 41RF | 19.49 \pm 0.42 | ND | - | ND |
| 42RF | 16.9 \pm 0.39 | ND | - | ND |
| 43RF | 6.68 \pm 0.25 | ND | - | ND |
| 44SF | 8.12 \pm 0.16 | ND | - | ND |
| 45SF | 10.31 \pm 1.67 | ND | - | ND |
| 46SF | 43.24 \pm 0.84 | 17.58 \pm 0.84 | + | ++ |
| 47SF | 15.67 \pm 0.15 | ND | - | ND |
| 48SF | 38.95 \pm 0.5 | 6.84 \pm 0.97 | + | ND |
| 49SF | 14.03 \pm 0.11 | ND | - | ND |
| 50SF | 21.17 \pm 0.45 | ND | - | ND |
| 51SF | 21.79 \pm 0.65 | ND | - | ND |
| 52SF | 33.66 \pm 0.05 | 40.7 \pm 0.69 | ++ | ++ |
| 53SF | 11.81 \pm 0.33 | ND | - | ND |
| 54SF | 19.42 \pm 0.67 | ND | - | ND |
| 55SF | 15.97 \pm 0.42 | ND | - | ND |
| 56LF | 28.87 \pm 1.2 | 4.42 \pm 1.24 | + | ND |
| 57LF | 28.87 \pm 0.98 | ND | - | ND |
| 58LF | 16.76 \pm 0.56 | ND | - | ND |
| 59LF | 27.93 \pm 1.11 | 3.63 \pm 0.79 | + | ND |
| 60LF | 28.08 \pm 0.8 | ND | - | ND |
| 61LF | 25.81 \pm p.97 | ND | - | ND |
| 62LF | 12.03 \pm 0.42 | ND | - | ND |
| 63LF | 6.16 \pm 0.98 | 7.6 \pm 1.4 | + | ND |
| 64LF | 6.38 \pm 0.88 | ND | - | ND |

*ND, +, and ++ denote no, low, and high production, respectively. Values are means \pm SE (n= 3).

SUPPLEMENTARY TABLE 3. Extracellular enzymatic activities produced by endophytic bacteria and fungi

| Isolate code | Extracellular enzymatic activities | | | Isolate code | Extracellular enzymatic activities | | |
|--------------|------------------------------------|---------|-----------|--------------|------------------------------------|---------|-----------|
| | Cellulase | Amylase | Cellulase | | Cellulase | Amylase | Cellulase |
| 1RB | ND | ++* | ND | 37RB | ++ | ++ | ++ |
| 2RB | ND | ++ | ND | 38RB | ++ | ++ | ++ |
| 3RB | + | ND | ND | 39RB | + | ++ | ND |
| 4RB | ++ | ++ | + | 40RB | ++ | ++ | + |
| 5RB | ++ | ND | ++ | 41RB | ++ | ++ | ++ |
| 6RB | + | ND | ND | 42SB | ++ | ++ | + |
| 7RB | ND | ND | ND | 43SB | ND | ++ | ND |
| 8RB | + | ++ | ND | 44SB | ++ | ND | + |
| 9RB | + | ND | ND | 45SB | ++ | ++ | ND |
| 10RB | ND | ND | ND | 46SB | ++ | ++ | ++ |
| 11RB | ND | + | ND | 47SB | ++ | ++ | ++ |
| 12RB | ND | + | ND | 48SB | ND | ++ | ND |
| 13RB | ND | ++ | ND | 49SB | ++ | ND | ND |
| 14RB | ND | + | + | 50SB | ++ | ND | + |
| 15RB | ++ | ++ | ND | 51SB | ++ | + | + |
| 16RB | ++ | ND | ++ | 52SB | ++ | ++ | ++ |
| 17RB | + | ND | ND | 53SB | ++ | + | ND |
| 18RB | ++ | + | ND | 54SB | ++ | ++ | ++ |
| 19RB | ND | ND | ND | 55SB | ++ | ++ | ++ |
| 20RB | ++ | ++ | ++ | 56SB | ++ | ++ | ND |
| 21RB | ++ | ++ | ND | 57SB | ND | ND | ND |
| 22RB | ND | ++ | + | 58SB | ++ | ++ | ++ |
| 23RB | ND | + | +++ | 59SB | ++ | ++ | + |
| 24RB | + | ND | ND | 60SB | ++ | ND | ND |
| 25RB | ++ | ++ | ++ | 61SB | ++ | ND | ND |
| 26RB | ++ | ++ | ++ | 62SB | + | + | ++ |
| 27RB | ++ | ND | ++ | 63LB | ++ | ++ | + |
| 28RB | ++ | ND | ++ | 64LB | ND | ND | ND |
| 29RB | ++ | + | ++ | 65LB | ND | + | ND |
| 30RB | ++ | ND | + | 66LB | ND | ++ | ND |
| 31RB | ++ | ++ | + | 67LB | ND | ND | ND |
| 32RB | ++ | + | ++ | 68LB | + | ++ | ND |
| 33RB | ++ | ++ | ++ | 69LB | ND | ND | + |
| 34RB | ++ | ++ | ++ | 70LB | ND | ND | ND |
| 35RB | ++ | ++ | ++ | 71LB | ND | ++ | ND |
| 36RB | ++ | + | ND | 72LB | ND | ++ | ND |

SUPPLEMENTARY TABLE 3. Cont.

| Isolate code | Extracellular enzymatic activities | | | Isolate code | Extracellular enzymatic activities | | |
|--------------|------------------------------------|---------|-----------|--------------|------------------------------------|---------|-----------|
| | Cellulase | Amylase | Cellulase | | Cellulase | Amylase | Cellulase |
| 73LB | + | + | ND | 19RF | - | ++ | - |
| 74LB | ++ | ++ | ND | 20RF | - | + | - |
| 75LB | ++ | ++ | ND | 21RF | - | + | + |
| 76LB | ND | ND | + | 22RF | - | - | - |
| 77LB | + | ND | ++ | 23RF | - | - | - |
| 78LB | ++ | ND | ND | 24RF | - | + | + |
| 79LB | ++ | ND | + | 25RF | - | - | + |
| 80LB | ND | + | ND | 26RF | - | + | + |
| 81LB | ++ | ++ | ++ | 27RF | - | - | + |
| 82LB | ++ | ND | + | 28RF | - | + | + |
| 83LB | ND | + | ND | 29RF | - | - | - |
| 84LB | ++ | ND | ND | 30RF | - | + | + |
| 85LB | ++ | ND | ND | 31RF | - | + | + |
| 86LB | ++ | ++ | ++ | 32RF | - | - | - |
| 87LB | + | ++ | ND | 33RF | - | - | - |
| 88LB | ++ | ++ | ++ | 34RF | - | + | ++ |
| 89LB | ++ | ++ | + | 35RF | - | - | + |
| 90LB | ND | ++ | + | 36RF | | + | + |
| 1RF | + | + | ++ | 37RF | + | + | + |
| 2RF | + | + | ++ | 38RF | | + | + |
| 3RF | - | - | - | 39RF | | + | + |
| 4Rf | + | + | ++ | 40RF | | - | - |
| 5RF | + | + | ++ | 41RF | - | - | - |
| 6RF | + | + | ++ | 42RF | + | ++ | + |
| 7RF | ++ | +++ | +++ | 43RF | - | + | - |
| 8RF | - | + | +++ | 44SF | - | - | - |
| 9RF | +++ | +++ | +++ | 45SF | - | - | + |
| 10RF | +++ | ++ | +++ | 46SF | ++ | + | ++ |
| 11RF | - | - | + | 47SF | + | - | + |
| 12RF | + | + | + | 48SF | + | + | + |
| 13RF | + | ++ | ++ | 49SF | + | + | + |
| 14RF | + | + | + | 50SF | - | + | - |
| 15RF | + | + | ++ | 51SF | + | + | + |
| 16RF | + | - | + | 52SF | + | + | + |
| 17RF | + | ++ | + | 53SF | - | - | - |
| 18RF | - | - | + | 54SF | - | - | + |

SUPPLEMENTARY TABLE 3. Cont.

| Isolate code | Extracellular enzymatic activities | | |
|--------------|------------------------------------|---------|-----------|
| | Cellulase | Amylase | Cellulase |
| 55SF | - | - | ++ |
| 56LF | - | - | + |
| 57LF | - | - | - |
| 58LF | + | + | ++ |
| 59LF | + | + | + |
| 60LF | + | + | - |
| 61LF | + | + | + |
| 62LF | - | ++ | + |
| 63LF | + | + | ++ |
| 64LF | - | ++ | - |
| 55SF | - | - | ++ |
| 56LF | - | - | + |
| 57LF | - | - | - |
| 58LF | + | + | ++ |
| 59LF | + | + | + |
| 60LF | + | + | - |
| 61LF | + | + | + |
| 62LF | - | ++ | + |
| 63LF | + | + | ++ |
| 64LF | - | ++ | - |

*ND, +, and ++ denote no, low, and high production, respectively.